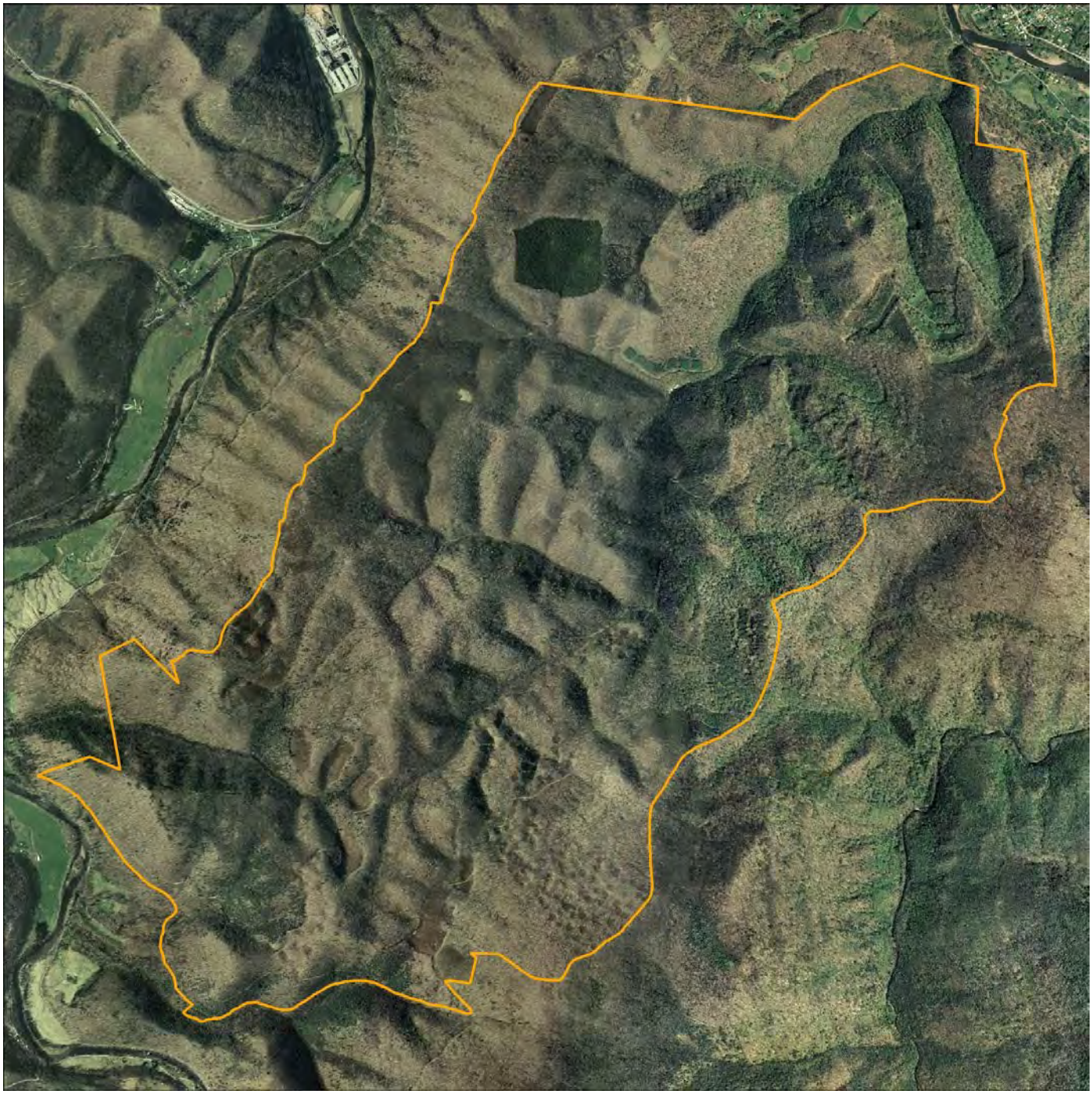
Fernow Experimental Forest
Virtual Tour



USDA Forest Service
Northern Research Station
Timber & Watershed Laboratory
Parsons, WV

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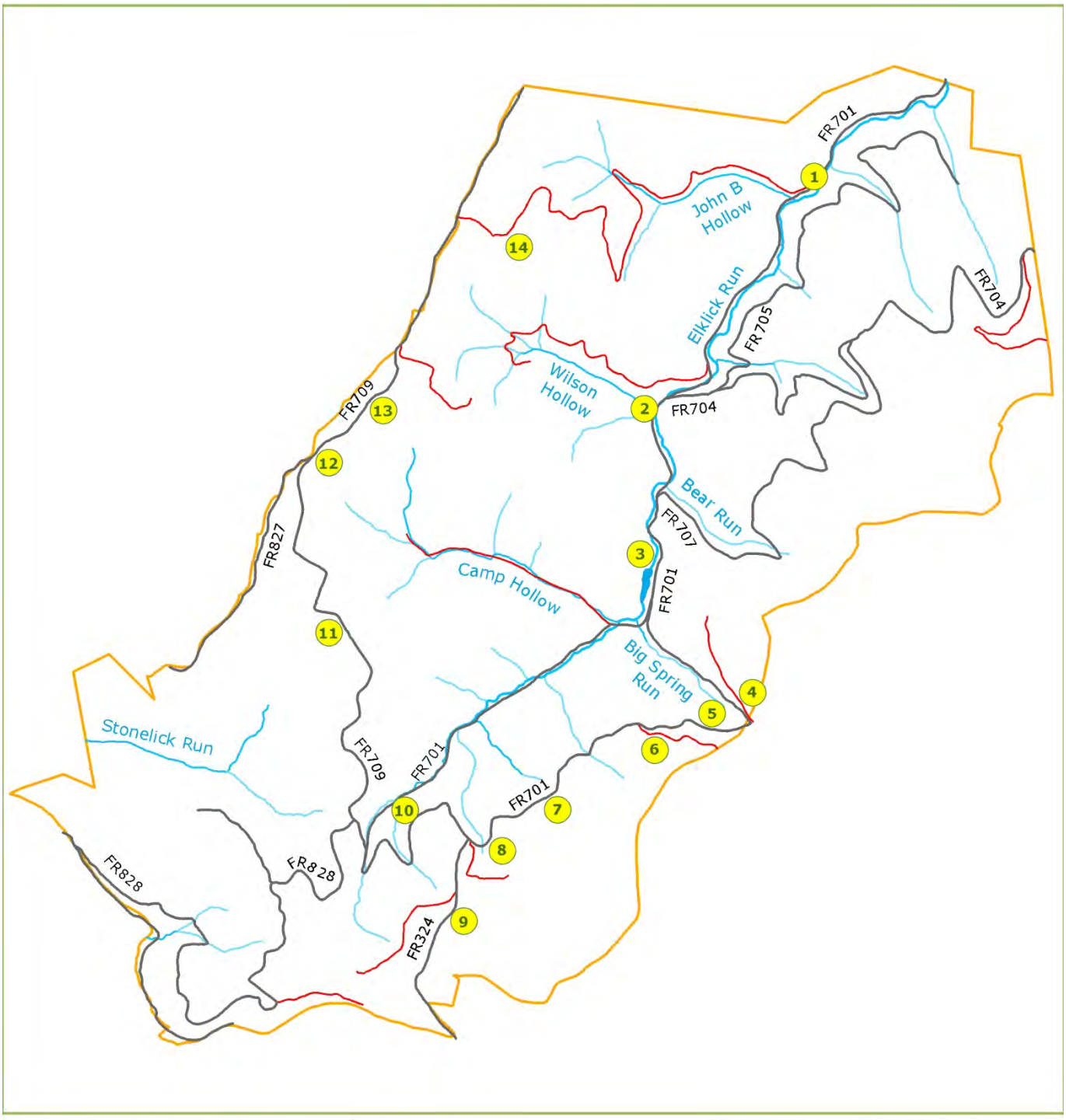

Open road
Trail or closed road
Reservoir
Stream
Fernow Experimental Forest

N

0 0.25 0.5 1 Miles

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UTM 17N, NAD83
November 16, 2011

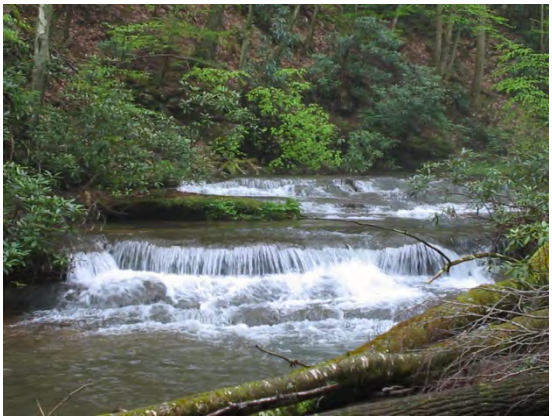
1 Elklick Run

The Fernow Experimental Forest was established in 1934 when the Elklick Run watershed, a portion of the newly created Monongahela National Forest, was designated for research and demonstration of forestry practices. The Monongahela was acquired from private ownership when purchased in 1915 by the authority of the Weeks Act of 1911, which authorized the establishment of the first eastern National Forests. The experimental forest was named after Bernhard E. Fernow, a German-born forester who pioneered scientific forestry in the United States. When established, the Fernow comprised 3,640 acres and was expanded to about 4,600 acres in 1974.

The main channel of Elklick Run is a perennial stream that supports a number of fish species, including native brook trout. The main road in the Fernow (FR701) parallels Elklick Run for most of its length and several pullouts are available for viewing the scenery. The stream is particularly scenic during the winter months but the road is often icy.

Timber in the Elklick Run watershed was harvested originally from 1903 to 1911. A railroad, traces of which can still be seen today, was built adjacent to the stream and used to transport logs to a sawmill near Elklick Run's confluence with the Black Fork River. Logs were most often pulled to the railroad by horses, but occasionally log slides were used.

Downstream of the reservoir (see stop 3) most of Elklick Run's streambed is bedrock. This is because sediments carried by stream water are deposited in the reservoir. Since water flowing over the dam is not carrying much sediment, it has a lot of energy to erode soil from the streambed; consequently, the underlying bedrock is exposed. This process has created a long series of small beautiful waterfalls, but stream habitat for trout and other aquatic organisms has been degraded.



Additional reading:

Fansler, H. F. 1962. History of Tucker County, West Virginia. McClain Printing Co., Parsons, WV. 702 p.

2 Wilson Hollow Weir

This monitoring station, or weir, is measuring streamflow from the largest gauged watershed (325 acres) on the Fernow. The concrete dam (cutoff wall) is anchored to bedrock across the stream channel so that all the water draining from the watershed flows through the control section (V-notch). The weir pond and a stilling well located beneath the weir house are connected by pipes so that water levels can be measured accurately in a protected enclosure. A digital water-level logger records the height of water every 5 minutes. These measurements enable scientists to determine the quantity and timing of streamflow draining from the watershed.

Another stream-gauging station on Watershed 1 is located 100 yards up the trail to the left. A slightly different kind of weir is used at Watershed 1 to measure streamflow because this watershed is much smaller (74 acres) than the Wilson Hollow watershed. Watershed 1 weir was built in 1951. It is one of the 5 original experimental watersheds on the Fernow. In 1957-58, timber stands on four of the watersheds received different cutting treatments, with one watershed designated as an uncut control. Watershed 1 was cut using a “logger’s choice” method without the implementation of best management practices to protect water quality. All trees larger than 6 inches in diameter were cut.

One year after harvest

Water quality was seriously impacted during and the first year after logging. Turbidity, a measure of sediment in water, was as much as 2,000 times higher here than on the control watershed. But turbidity improved by the end of year 2, returning to pre-logging levels.

Annual streamflow increased due to logging by 12 to 19 percent during the first three years after harvesting; most increases occurred in the summer. Storm peakflows increased approximately 4 percent while total stormflow volumes increased 13 percent.

3 Reservoir

Constructed in 1934-36 by the Civilian Conservation Corps, this reservoir was the primary source of water for residents of the City of Parsons until 1996.

During high flows rock and sediment are deposited in the reservoir. The reservoir was emptied and dredged every 10 to 20 years to maintain an adequate water supply.

1957 dredging

Now the reservoir provides habitat for wood ducks, fish and other wildlife.

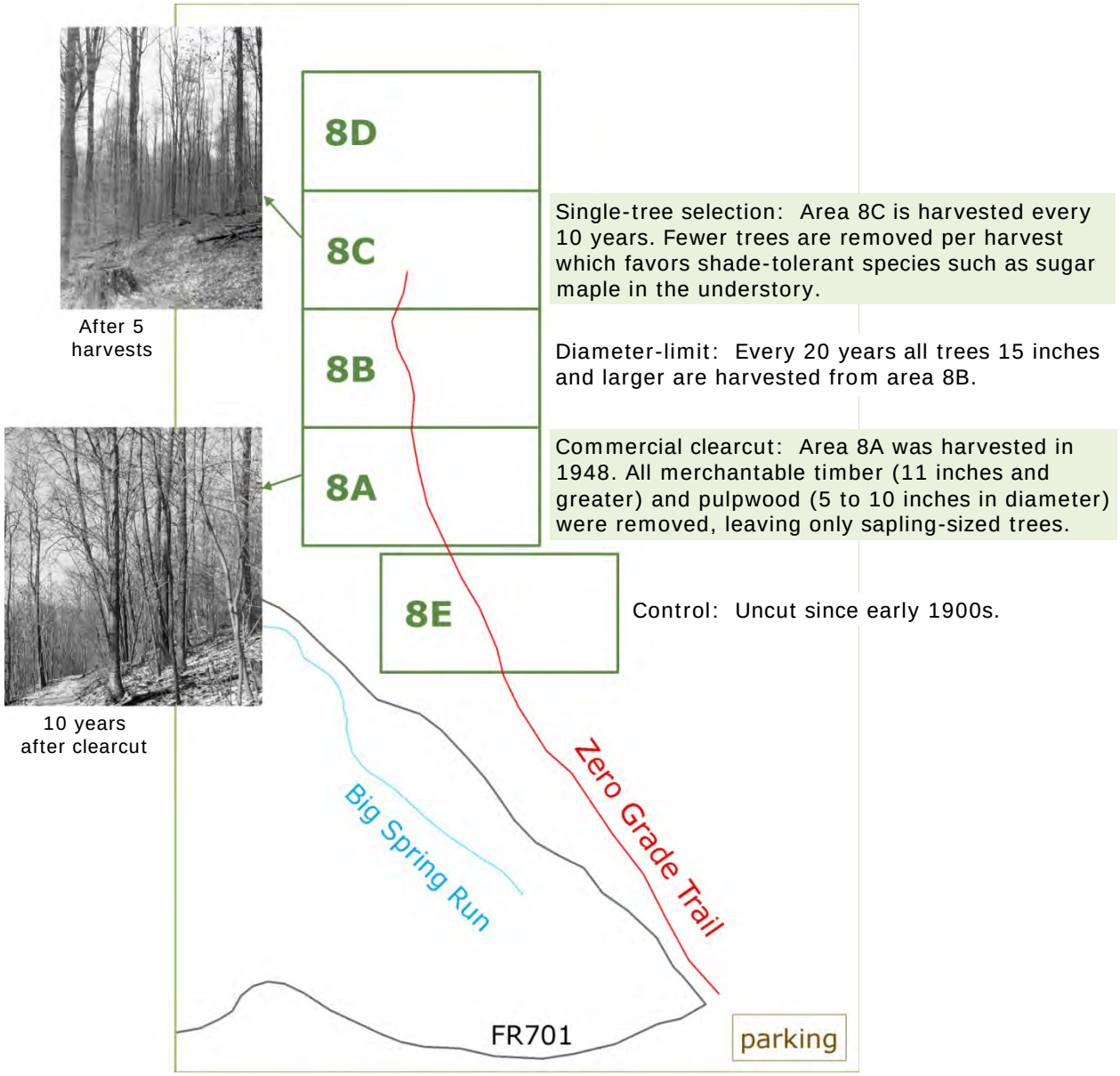
River otter

Wood duck

Brook trout

4 Zero Grade Trail (walking stop)

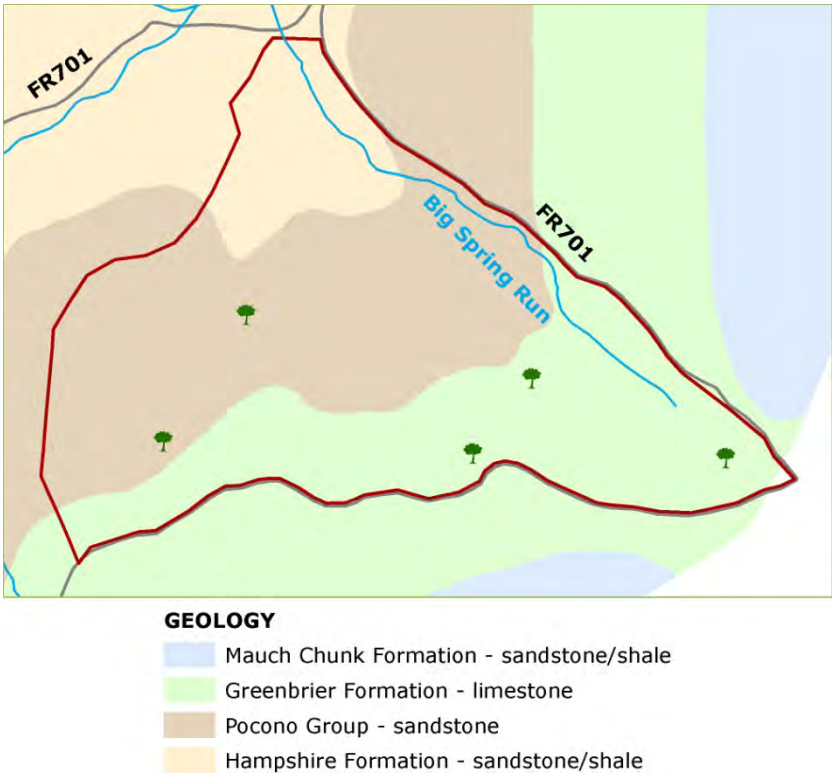
The Zero Grade Trail provides access to some of the oldest research and forest management demonstration areas in the eastern United States. Four cutting treatments and an uncut control were established in 1949. The original objective was to compare "good" and "poor" forestry practices. The current objective is to quantify long-term stand dynamics as affected by the different treatments: single-tree selection, diameter-limit cutting, and commercial clearcutting.



As the name implies, the trail was located to minimize the effect of the rugged terrain. Original construction was done by the Civilian Conservation Corps in the 1930s. The trail was upgraded in 1994 to universal access design standards for remote forest settings. The trail is approximately ½-mile long.

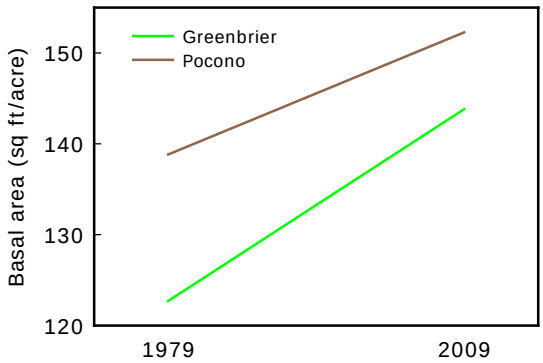
5 Biological Control Area

This forest stand with its many 100-year-old trees is designed to remain as an undisturbed control area. Its growth and development will be compared to managed stands treated with various silvicultural practices, such as harvesting, thinning and prescribed fire.



Untreated areas also allow scientists to compare and contrast the effects of environmental factors on forest growth and development. Five plots (tree symbol) were established in the Biological Control Area in 1979 and re-measured in 2009 to track tree growth.

A simple comparison of tree growth by geology shows that the plots on the soils derived from Greenbrier limestone were more productive (growing at a faster rate as shown by the steeper green line) over the 30-year period than plots on the soils derived from Pocono sandstone.



6 Even-aged Management (walking stop)

An even-aged stand is one in which the dominant trees began to grow at about the same time and developed under essentially full light conditions. Even-aged management provides more successful reproduction and early development of tree species that need direct sunlight - yellow-poplar, white ash, basswood, black cherry, and red oak. The dense, uniform canopies of maturing even-aged stands restrict the amount of light hitting tree trunks. This lessens the chance for excessive branching, which can cause knotty wood.

Site before first cut in 1961

Some “seed trees” were left to help provide seeds for natural regeneration

Seed trees were harvested in 1964

Today, the dominant trees in this stand are 50 years old, and the stand has been thinned twice to improve growing conditions of the uncut trees. Management effects on reproduction, development, and quality of central Appalachian hardwoods have been documented in this study.

This study area is accessed by following the Turkey Run Trail. If you visit in late April/early May an expansive display of bluebells and other spring wildflowers will welcome you. Picking flowers or removing plants is prohibited on the Fernow. Please leave them for others to enjoy.

7 Crop-tree Management

This compartment is used to study crop-tree management in mature central Appalachian hardwoods. Crop trees are trees favored for their potential to produce high-quality wood, provide food or shelter for wildlife, or other desired benefits. The area is divided into four 6-acre treatment units. Within each unit, crop trees to keep were selected using the "crown-touching" approach (crop trees are far enough apart that their crowns do not touch).

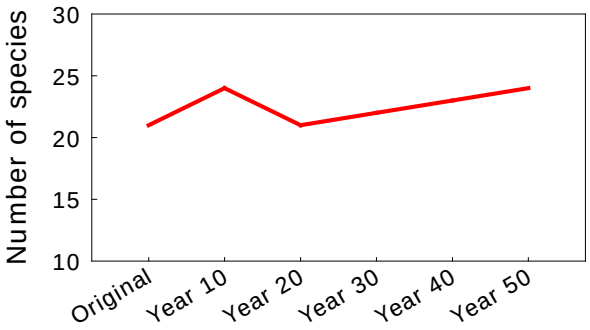
Cutting treatments were applied to each area in 1989. The treatments varied from removing only trees touching the selected crop trees to removing all trees except the selected crop trees. Where all trees except crop trees were removed, a two-age stand is developing where the taller trees are approximately 80 years older than the young trees growing beneath them. Residual trees in all treatment areas are growing faster because competing trees have been removed.

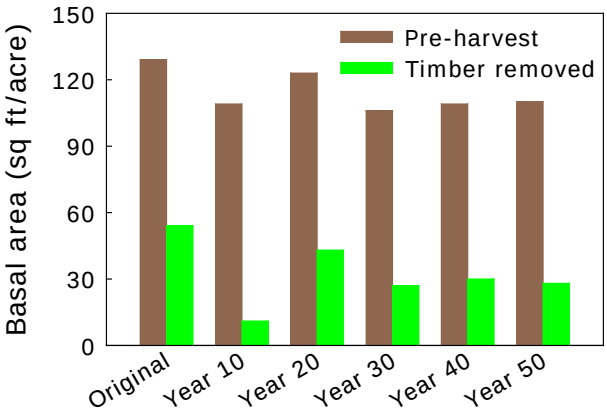
The mineral rights below the Fernow are not owned by the Forest Service. A natural gas well was drilled in this study area in 2008; additional construction included an access road and gas pipeline. The effects of these disturbances also are being studied.

8 Patch Cutting

Patch harvests are made by cutting all the trees in 0.4-acre openings. These openings are large enough to provide sufficient sunlight for shade-intolerant species, such as yellow-poplar and black cherry.

Approximately 4 acres of this 28-acre study area are cut every 10 years. The sixth harvest was made in 2005. After each patch cut a new age class begins to develop. This area has a relatively high density of species, age classes, and vertical strata while maintaining a consistent amount of growing stock (basal area).





Study area (along road) and 2 upslope companion areas seen from the air

9 Uneven-aged Management

Uneven-aged management entails maintaining trees of different size classes in the same area. Successful uneven-aged management calls for approximately equal, periodic harvests. Partial cuts are applied here every 10 years.

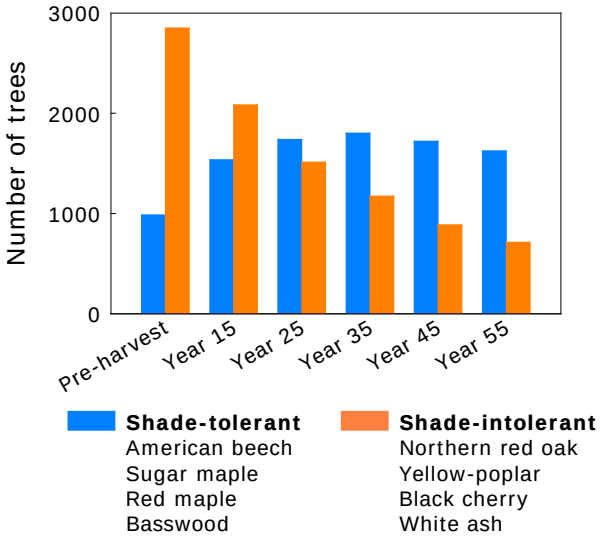
1952 pre-harvest

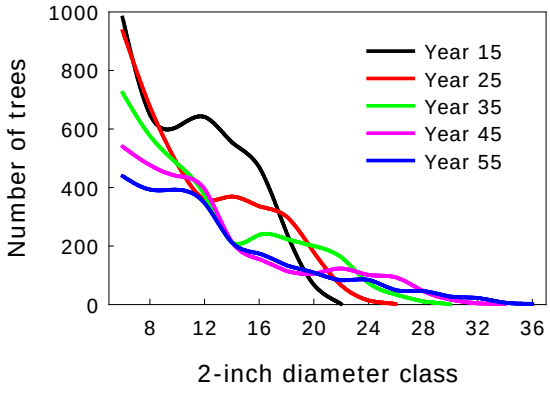
1977 after 3 cuts

1987 after 4 cuts

2006 after 6 cuts

Cutting individual trees does not create large enough openings to allow shade-intolerant (light-demanding) trees to become established. Data collected since 1958 indicate that the number of shade-intolerant trees in this stand is decreasing, while there has been an increase in shade-tolerant trees.



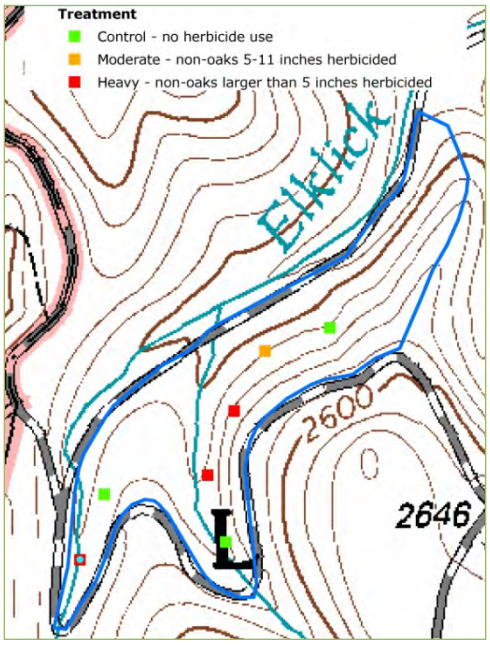


Under this practice, trees are individually selected for removal so a desired number of trees in each size (i.e., diameter) class are left. Each harvest stimulates reproduction of new trees and enhances the growth of older trees.

10 Prescribed Fire

The research in this area is studying the effects of removing competing vegetation on oak regeneration. Prescribed fire is used to reduce understory competition and herbicides are used to reduce overstory competition. Use of the dead trees (snags) by roosting bats also is being studied. Six areas totaling 363 acres on the Fernow are included in this study.

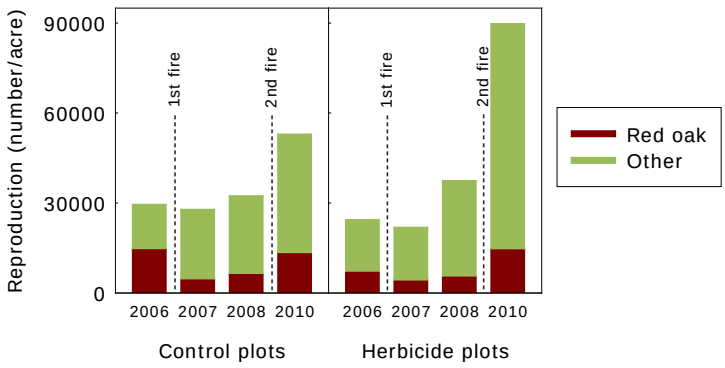
Seven ½-acre plots were established in this 31-acre area in 2006. Reproduction and snag condition data were measured annually for 5 years. Treatment began in 2007 when the entire area was burned.



In 2008 two different herbicide treatments were applied to four plots while three were left as untreated control plots. The moderate herbicide treatment killed all trees 5 to 11 inches in diameter which were not oak or hickory on the selected plots while the heavy herbicide treatment killed all trees larger than 5 inches in diameter. The area was burned again in 2009.

Radio telemetry was used to track bats to roost trees. Preliminary results indicate female northern long-eared bats selected smaller roost trees in larger canopy gaps in burned areas vs. unburned areas.

Total reproduction increased noticeably after the herbicide treatments and second prescribed fire, but it is too early to tell if the oaks will survive to become a larger percentage of the overstory.



11 Financial Maturity

Financial maturity is a harvesting prescription that combines economic guidelines for individual trees, high-priority removal of poor-quality sawtimber-sized trees, and guidelines for how much growing stock (i.e., number of sawtimber-sized trees) to leave at each harvest. Fernow scientists and others developed this silvicultural system in the early 1970s as a more sustainable alternative to diameter-limit harvesting.

Six areas on the Fernow are included in a financial maturity study comparing different economic guidelines. This area was established in 1974, randomly assigned a 3% rate of return (vs. 2% or 4%), and has been harvested about every ten years beginning in 1975. Site quality is average.

Example economic guidelines for 3% rate of return

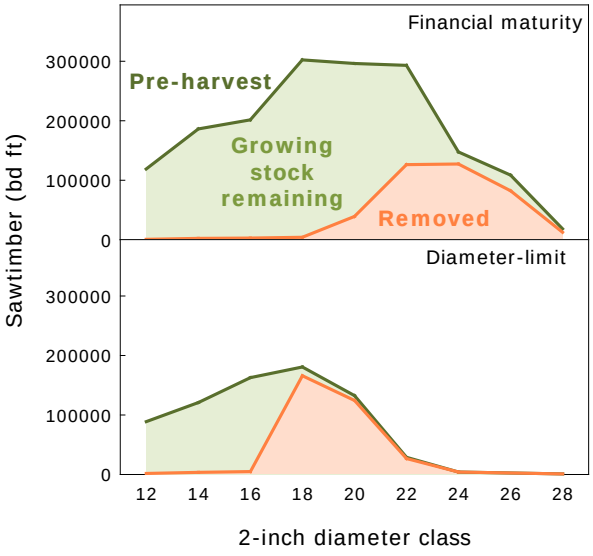
Species	Diameter at which tree is harvested (inches)
Black cherry	26
White ash	24
White oak	20

Stand improvement guidelines for all rates of return for trees > 11 inches diameter

- Cut all culls
- Cut trees with significant butt-log rot
- Cut very low vigor trees
- Cut extremely rough trees
- Cut short-lived species

Compared to diameter-limit harvesting, the financial maturity method maintains a greater amount of growing stock in all size classes.

In the example, this area was compared to another stand of similar initial conditions and site quality. After four harvests, many large trees are left to increase in value until the next periodic harvest in 10 years.



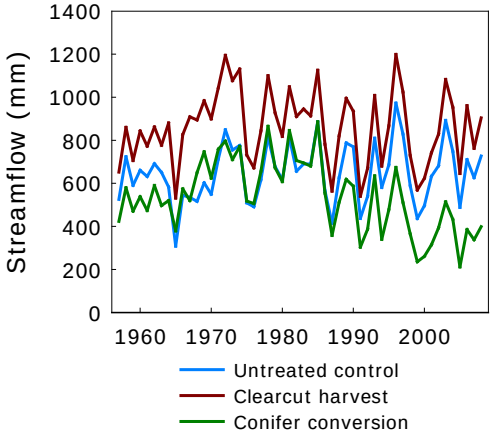
12 Watershed 4

Since 1951 this watershed has been used as an untreated control for both watershed-based and silviculture studies.

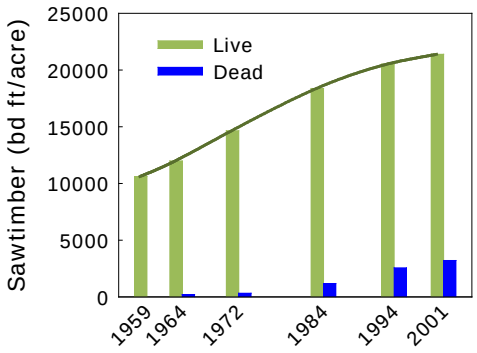
On the watershed side, water quantity and quality data from this untreated watershed are compared to data from treated watersheds. Scientists can determine the degree of hydrologic change resulting from different treatments as well as changes due to environmental or human-caused factors, such as acid deposition and climate change.

On the silviculture side, this watershed serves as a regional example of how a forest stand naturally changes as it ages. Its condition and health are compared to areas treated by the many different management systems studied on the Fernow to determine how those systems affect species diversity, productivity, sustainability and financial return.

weather station



Streamflow is naturally highly variable year-to-year, but differences among treatments still are visible

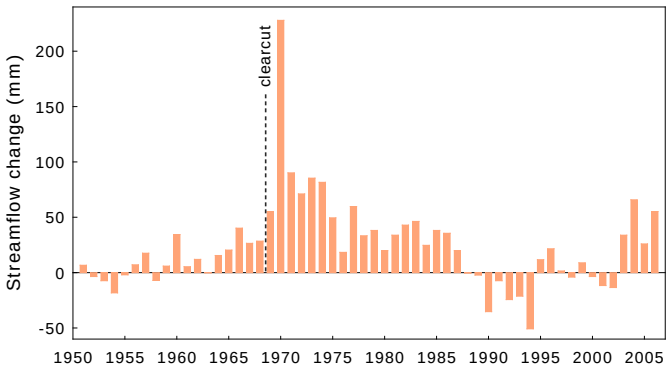


Growth of marketable timber has begun to slow while mortality has increased as the stand nears age 100

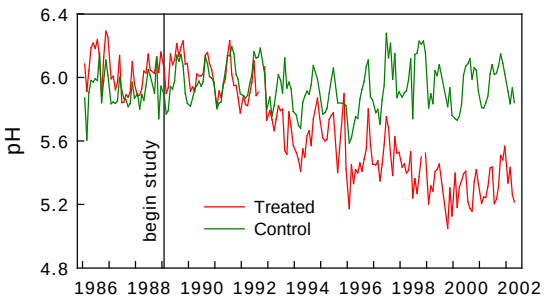
13 Watershed 3

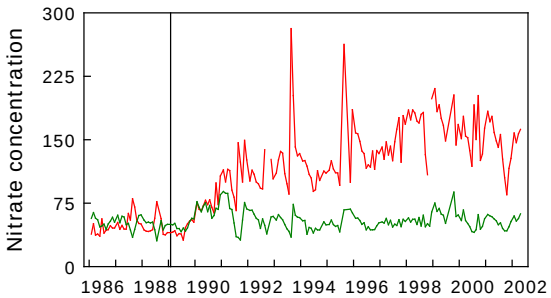
This area tells a tale of two studies – the first examined harvesting effects on hydrology and species composition, while the second is quantifying some effects of acid deposition on forest ecosystems.

In 1969 the entire watershed was clearcut down to 1-inch diameter except for a 7.4-acre protective strip of uncut trees left along each side of the stream channel. The primary purpose of this study was to evaluate the effects of clearcutting on the quantity and quality of stream water.



In 1989, a new experiment was begun on this watershed. Ammonium sulfate fertilizer has been applied aerially to the whole watershed three times per year to mimic and accelerate the effects of acid deposition. From this research, we have learned that the soil and water chemistry tend to be affected more quickly than the forest trees.

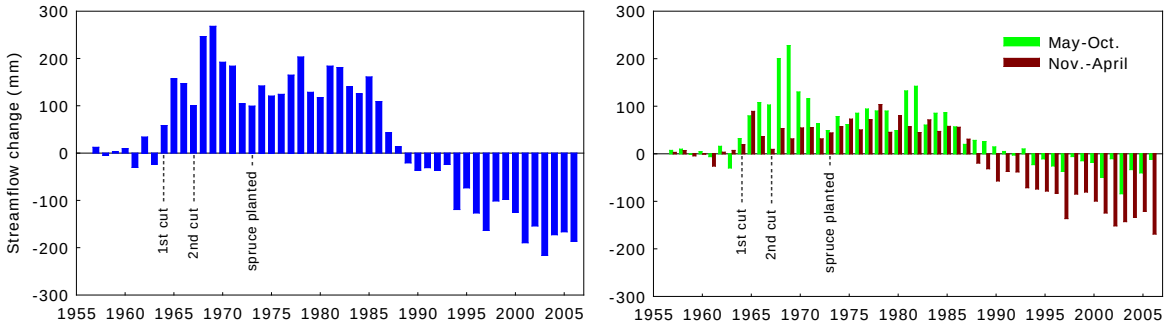




Stream chemistry response to acidification treatment

14 Watershed 6 (walking stop)

The experiment on this watershed studies the effects of vegetation manipulations on water quantity. The watershed was clearcut in two stages – the lower half in 1964 and the upper half in 1967. Herbicides were used on both halves through 1969 to stop regrowth and determine the maximum streamflow increase that could be induced. In 1973 the watershed was planted with Norway spruce; it is the only area on the Fernow with a predominantly coniferous stand.



Initially streamflow increased after harvesting, primarily during summer. Later, streamflow decreased as the growing spruce stand used more water than the original hardwood stand in the summer, and more snow was evaporated from their canopies in the winter.

The spruce stand has created a very different ecosystem than any other area on the Fernow. Due to the decreased streamflow, the channel has become very narrow and like a wetland stream with thick mats of moss. The temperature in the watershed is much cooler, especially near the bottom of the watershed. Many different types of fungi are found on the forest floor. The dense cover provided by the spruce attracts numerous wildlife species.